arm NEOVERSE

The Cloud to Edge Infrastructure Foundation
for a World of 1T Intelligent Devices
Arm #1 market share in Infrastructure!

- Top-of-Rack Switches
- Cellular Base Stations
- Gateways
- WAN Routers
- Servers

**Infrastructure Processor Unit Market Share**

Source: IDC and Arm *thru 6/2018

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Media content distribution and consumption drive today’s Internet infrastructure design

Create & Distribute

Cloud Data Centers

Media Content

Billions of Phones

Consume
Data consumption is driving future designs

Cloud Data Centers

Critical Data

Edge

5G

Massive Amounts of Data

Trillions of Devices

Analyse & Store

Filter & React

Local Decisions
The Cloud to Edge Infrastructure Foundation for a World of 1T Intelligent Devices

- High Performance, Secure IP and Architectures
- Diverse Solutions and Ecosystem
- Scalable from Hyperscale to the Edge
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arm NEOVERSE
Infrastructure Roadmap
Leverages Process Nodes

- 16nm Cosmos Platform
- 7nm Ares Platform
- 7nm+ Zeus Platform
- 5nm Poseidon Platform

30% Faster System Performance per Generation + New Features

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Arm Neoverse architecture partners offer world-class solutions designed at the microarchitecture level.

- I/O, buses, interconnect fabric
- Pipeline length, width, depth
- SIMD width and depth
- Memory hierarchy
- Threading architecture
- Unique IP
All solutions designed around a security centric and compliant model

Secure Arm Platform

- Arm ServerReady test suite
- Ecosystem security software
- Ecosystem IP
- Arm platform standards
  - Industry standards
    - TCG, NIST, OCP
- Neoverse CPU and System IP
  - Cryptolisland Secure Enclave
- Arm TrustZone Architecture - system-wide hardware isolation

LEGEND
- Arm ecosystem
- Compliance & standards
- Arm open-source SW
- Arm IP & Architecture

User Applications
- VM
- VM
- VM
- Container
- Container
- Container

Operating System
- Hypervisor
- UEFI/EDK-II boot loader
- Trusted firmware: PSCI, SMC, MM & SCMI

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Why do we need a standards-based approach?

Arm architecture supports a very diverse variety of devices

Diversity is good, but uncontrolled diversity is bad, particularly for servers

• Servers are very different to embedded devices – you have to install standard OSs which may even pre-date the SoC
• Installation process needs to ‘just work’
• Modifying the operating to suit the HW is not a viable option, as it is in embedded

Servers rely on standards to solve this - Common rules for hardware and for firmware
Arm Arch:
- Armv8.x-A
- SMMU
- GIC
- Extensions:
  - RAS
  - MPAM

**SBSA: Server Base System Architecture**

Hardware requirements for Arm-based infrastructure SoCs

Developed in conjunction with the server ecosystem

Arm architecture and system architecture and standards

Arm Specs

- PSCI
- SMCCC
- Arm TF
- Arm FFH
- Arm MM

SBBR: Server Base Boot Requirements

Firmware requirements for Arm based infrastructure SoCs
Developed in conjunction with the server ecosystem
Requirements for industry standards and Arm firmware specifications

Industry Standards

- UEFI
- ACPI
- SMBIOS
- TCG FW spec
- PCI FW spec

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Software and firmware development

We participate in important open source projects for server
- Linux kernel
- EDK2 for UEFI firmware
- Trusted Firmware–A – formerly Arm Trusted FW
- Open BMC

We also work with OS vendors that are not open source.
Compliance tools help in scaling out

- Like other segments the server ecosystem is complex and contains multiple vendors
- An OS vendor cannot check every possible system
- Compliance tools can help one vendor check the input they receive from another
  - e.g. OEM can check Silicon vendor HW is compliant with SBSA hardware requirements
  - OSV can check ODM is compliant with SBSA hardware requirements and SBBR firmware requirements
- There is no specification without verification
- For these reasons, we introduced tests for our specifications and a compliance program
Arm ServerReady

It’s a set of tests:
- Architecture compliance test suites for SBSA/SBBR
- Booting of standard linux distros and smoke tests

It’s a compliance process:
- Partners run the tests, we help debug issues
- Once successful we provide a certificate

It’s a right to marketing materials:
- Partners can use the logo if they pass the process

https://developer.arm.com/products/architecture/platform-design/server-and-infrastructure
The Cloud to Edge Infrastructure Foundation for a World of 1T Intelligent Devices

High Performance, Secure IP and Architectures

Diverse Solutions and Ecosystem

Scalable from Hyperscale to the Edge
## Broad SoC system design options within Arm Ecosystem

<table>
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<tr>
<th>Arm IP</th>
<th>Arm Architectural design</th>
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<tbody>
<tr>
<td>High performance CPUs</td>
<td>Custom Arm High performance CPU</td>
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<tr>
<td>Data plane CPUs</td>
<td>Custom Fabric &amp; IP</td>
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<tr>
<td>CMN Fabric</td>
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<td>Other IP</td>
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<tr>
<th>Accelerators</th>
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<tbody>
<tr>
<td>ML, on-die FPGA</td>
<td></td>
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<tr>
<td>Networking, security, encryption</td>
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<tr>
<td>Video, Custom</td>
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<table>
<thead>
<tr>
<th>Memory</th>
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<tbody>
<tr>
<td>DDR, HBM, Flash, Storage Class memory</td>
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<tr>
<th>IO</th>
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<tr>
<td>PCIe, CCIX, 100G+ ethernet</td>
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<tr>
<th>Foundry</th>
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<tbody>
<tr>
<td>TSMC 7FF, Samsung 7LPP, UMC</td>
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</table>

**Common Software Platform and Ecosystem**
- Arm Architecture v8.x-A
Endorsed by a robust ecosystem

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<th>Cloud</th>
<th>Platforms</th>
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<td>Annapurna Labs</td>
<td>Hewlett Packard Enterprise</td>
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<td>Broadcom</td>
<td>Alibaba.com</td>
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<td>Samsung</td>
<td>Baidu</td>
<td>Huawei</td>
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<td>Qualcomm</td>
<td>Tencent Cloud</td>
<td>packet</td>
<td>Intel</td>
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<tr>
<td>Fujitsu</td>
<td>GIGABYTE</td>
<td>PEGATRON</td>
<td>TSMC</td>
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<td>MediaTek</td>
<td>Xilinx</td>
<td>NXP</td>
<td>ARM</td>
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<tr>
<td>Cadence</td>
<td>Synopsys</td>
<td>Mentor</td>
<td>ARM</td>
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Endorsed by a broad and growing open networking and server ecosystem

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<tbody>
<tr>
<td>redhat</td>
<td>docker</td>
<td>OpenJDK</td>
<td>shippable</td>
<td>Linaro</td>
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<td>SUSE</td>
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<td>ORACLE</td>
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<td>node</td>
<td>LF Networking</td>
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<td>CANONICAL</td>
<td>openstack</td>
<td></td>
<td>VEXXHOST</td>
<td>CLOUD NATIVE COMPUTING FOUNDATION</td>
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Vanguard Astra
WORLD’S MOST POWERFUL ARM SUPERCOMPUTER

• 2,592 HPE Apollo 70 compute nodes
  • 5,184 CPUs, 145,152 cores, 2.3 PFLOPs (peak)
• Marvell Thunder-X2 Arm SoC, 28 core, 2.0 GHz
• Memory per node: 128 GB (16 x 8 GB DR DIMMs)
  • Aggregate capacity: 332 TB, 885 TB/s (peak)

• Mellanox IB EDR, ConnectX-5
  • 112 36-port edges, 3 648-port spine switches
• Red Hat RHEL for Arm
• HPE Apollo 4520 All-flash Lustre storage
  • Storage Capacity: 403 TB (usable)
  • Storage Bandwidth: 244 GB/s
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